

US EPA ARCHIVE DOCUMENT

New Haven Pilot Project

Cumulative Air Pollution Reduction Programs and Environmental Public Health Indicators for Children and Elderly, New Haven, CT – A Feasibility Study

EPA ORD Research Approaches to Assessing Public Health Impacts of Risk Management Decisions

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Environmental Public Health Indicators for Children and Elderly New Haven, CT

Human Health Multi-Year Plan

Long Term Goal 4

Assessment of Risk Management Decisions

- Project originated from an ORD wide solicitation
- Regions submitted pre-proposals
- ORD design teams were established and created full proposals



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Study Objective

Assess the feasibility of conducting a cumulative air accountability study at a local scale (New Haven, CT)



Study Aims

- Identify existing human health, ambient air quality and human exposure-related data in New Haven, CT
 - Assess the availability and accessibility
- Determine the air pollution reduction activities and associated changes in emissions for multiple pollutants
- Refine, apply, and evaluate air quality and human exposure models that can be used with local health data
- Assess the feasibility of using this existing information to conduct an air accountability study
- Develop collaborations and partnerships with state and local agencies including government, academia, and the New Haven community
- Provide the methodologies developed under this project to future projects in other areas in the United States



New Haven, CT



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Why New Haven?



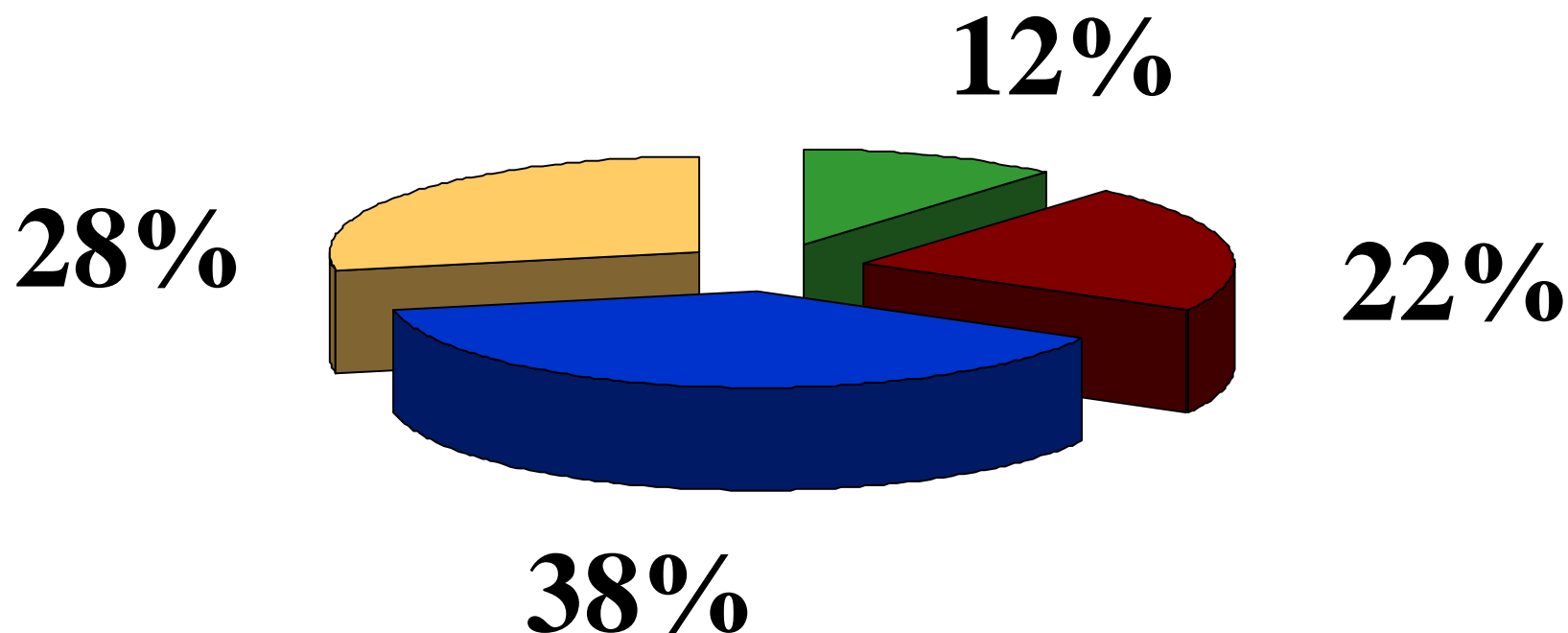
- Highest children asthma emergency room visits in CT
- NE County with 2nd highest NATA risks
- PM and Ozone noncompliance
- City, state & community partnerships and actions



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New Haven Inventory By Source Category



■ Point (114 tons)	■ Area (215 tons)
■ Onroad Mobile (389 tons)	■ Nonroad Mobile (279 tons)

Total HAPS = 997 tons
116 pollutants & groups

Weil M. (2004) New Haven Air Toxics Inventory and Risk Reduction Strategy.

[http://www.cityofnewhaven.com/CityPlan/pdfs/EnvironmentalInitiatives/AirToxicsProject/InventoryReport .pdf](http://www.cityofnewhaven.com/CityPlan/pdfs/EnvironmentalInitiatives/AirToxicsProject/InventoryReport.pdf)



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Regulatory and Voluntary Actions to Consider

- National regulations for mobile sources
 - Road
 - Non-road
- Voluntary actions for mobile sources
 - Road
 - Non-road
- National regulations for stationary sources
- Voluntary actions for stationary sources
- Indoor air reduction activities



Progress to Date



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Research Design Strategies, Data Sources, and Statistical Techniques

- White paper: outlines methodologies and tools that can be used for accountability research on a local city scale with the use of existing data
 - Utilized the HEI report “Assessing Health Impact of Air Quality Regulations: Concepts and Methods for Accountability Research”
 - Utilized epidemiologic papers on air pollution and health outcomes
 - Outside Consultations
- White paper will be used as a tool in assessing feasibility



Identification of Data Sources



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Identification of Data Sources

- Existing Ambient Air Quality Data
- Existing Exposure Data
- Existing Human Health Data



Identification of Data Sources (continued)

Existing Ambient Air Quality Data

- 6 ambient air monitors in City of New Haven operated by Connecticut Department of Environmental Protection
- Currently only 4 are active



New Haven, CT Air Monitoring Sites

Agricultural Center

Criscuolo Park

State Street

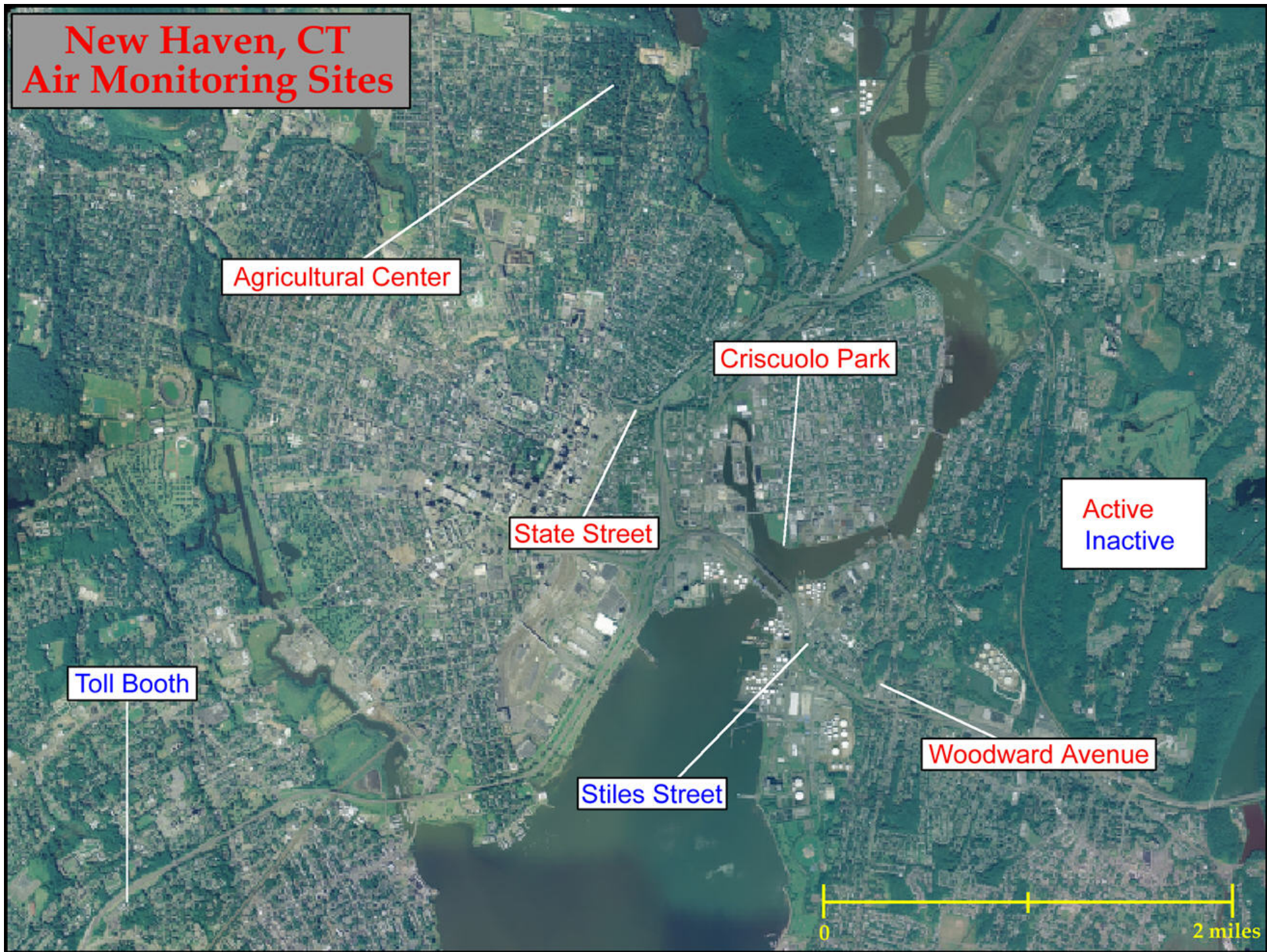
Active
Inactive

Toll Booth

Stiles Street

Woodward Avenue

0 2 miles



Identification of Data Sources (continued)

Existing Exposure Data

- None identified



Identification of Data Sources (continued)

Existing Human Health Data

- Hospital discharge data (CHIME)
- Vital records
- Birth defects registry
- Connecticut Department of Public Health's Asthma program
 - Asthma surveillance
 - School based asthma surveillance
- Medicaid data – HUSKY
- School absenteeism
- CT Tumor Registry
- Emergency services data
- Hill Health Community Health Center Data
- New Haven Health Project



Air Quality Models



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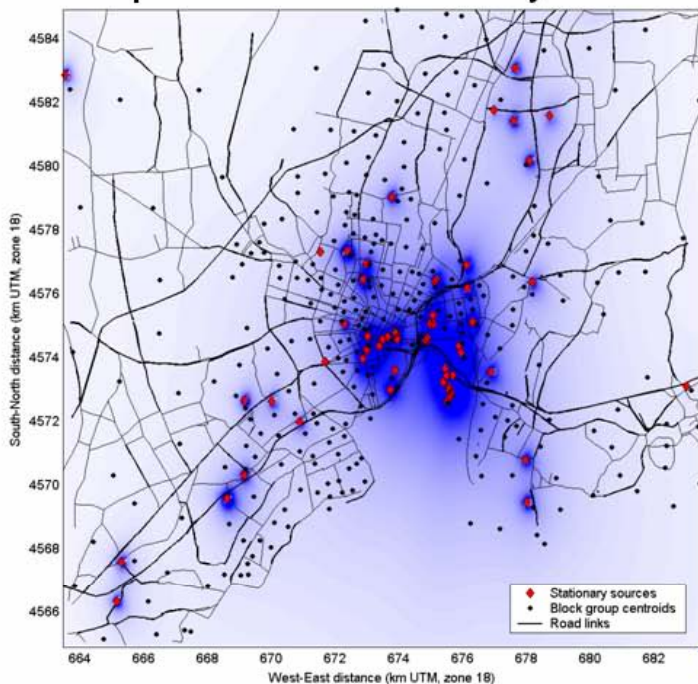
Modeling Ambient Concentrations

- PM, ozone, and selected air toxics concentrations in the study domain
- Hybrid modeling approach to resolve local scale, whereby:
 - CMAQ provides regional background and contribution from chemically-reactive pollutants
 - Near-source concentrations provided by local-scale dispersion models, e.g. AERMOD
 - Total (combined) concentrations used as input to estimate inhalation exposures

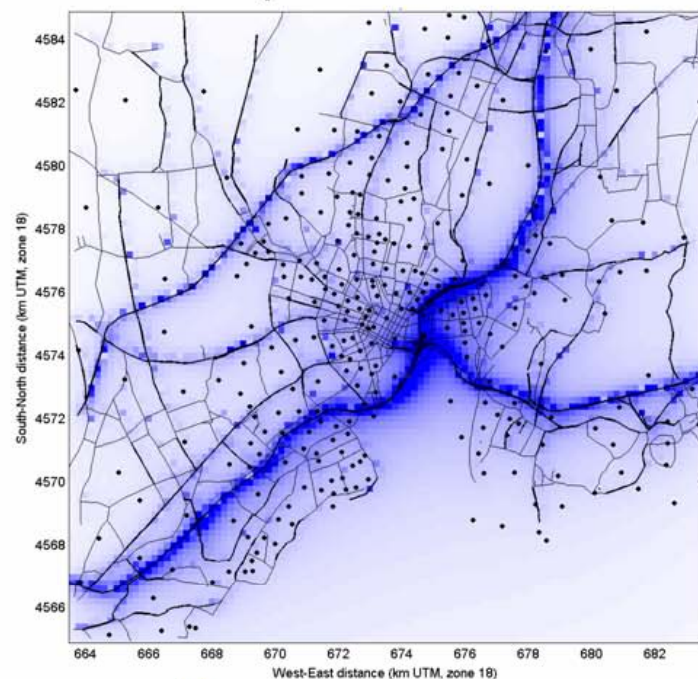


Hybrid Modeling Application in New Haven, CT

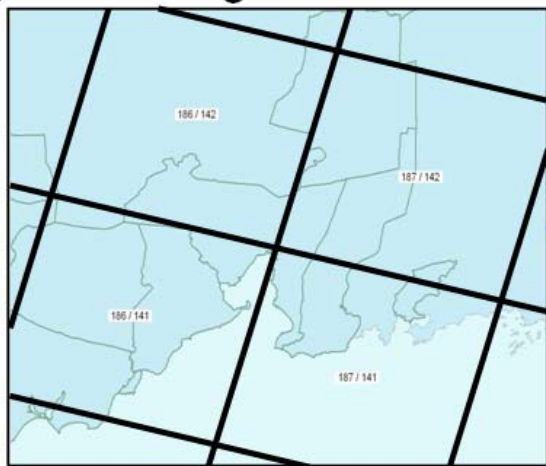
Local impact from stationary sources



Near-road impact from mobile sources



Regional background from CMAQ



Combined model results for multiple pollutants for each of the 380 census block group centroids in New Haven area

Preliminary Results for Benzene

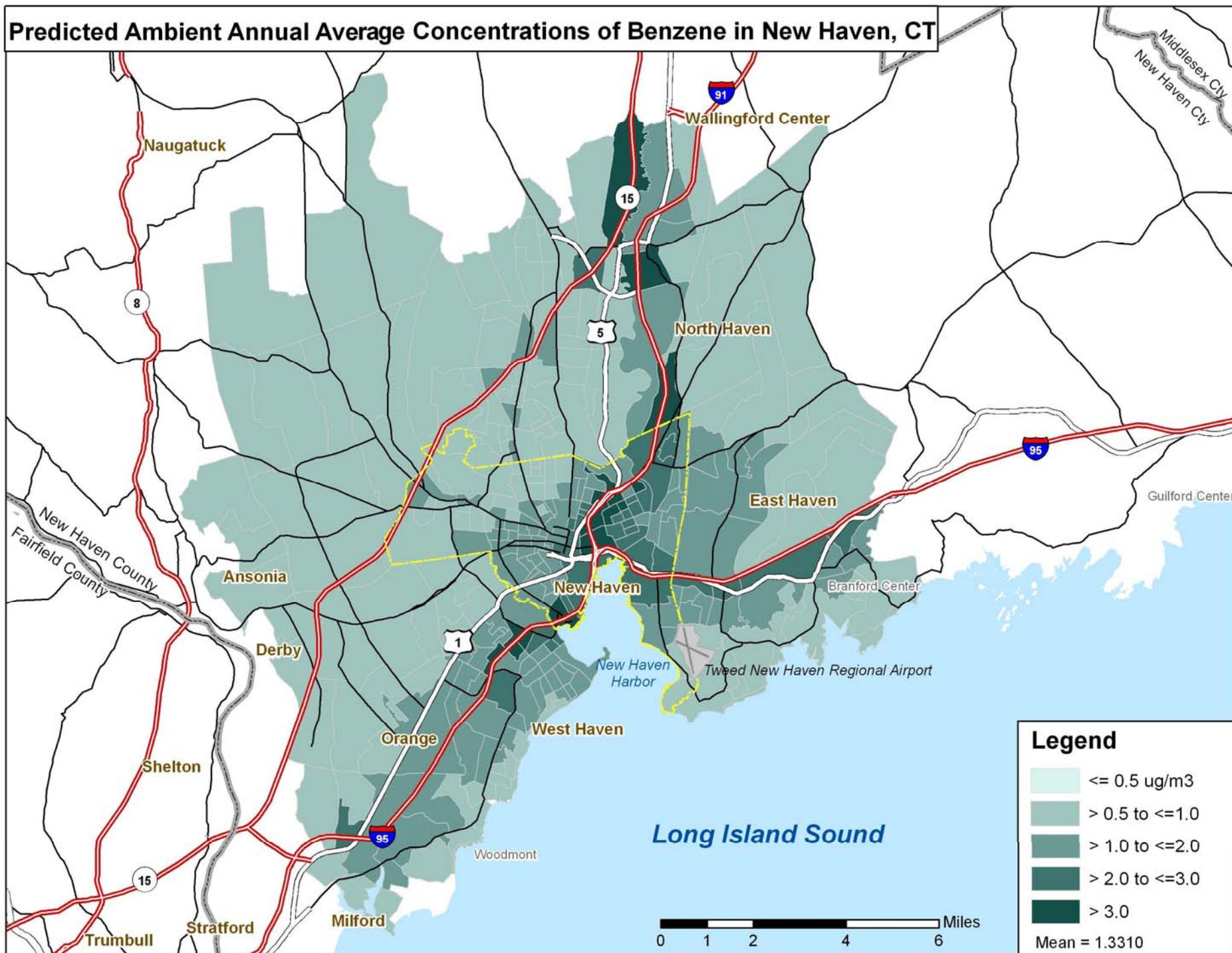
Hybrid Air Quality Modeling



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Predicted Ambient Annual Average Concentrations of Benzene in New Haven, CT

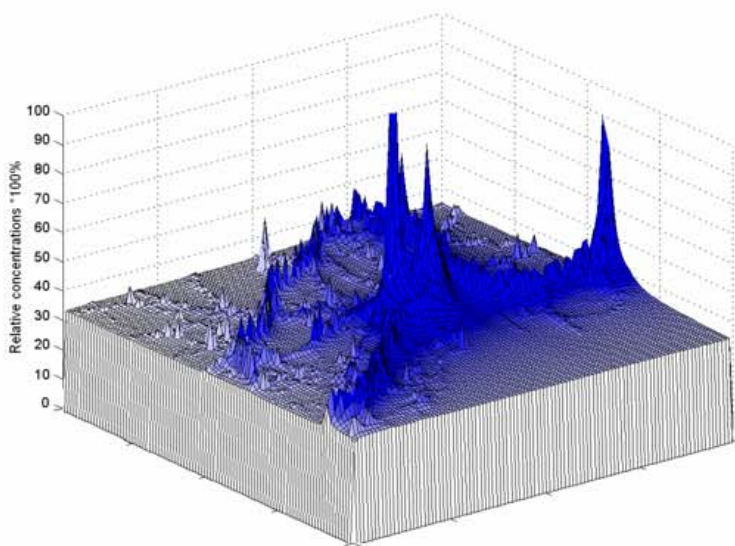


Application of Air Quality Models in Air Accountability Studies

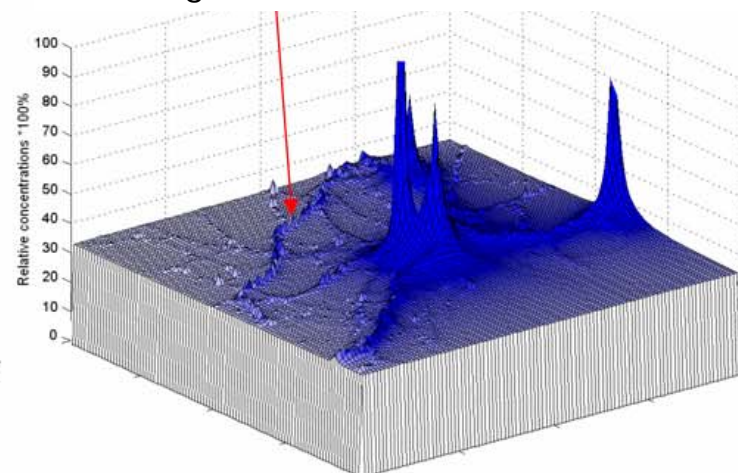
- Simulating air quality impacts for various controls scenarios, for example:
 - what happens if emissions from some specific stationary sources are reduced by “x” percent?
 - what happens if emissions from mobile sources could be reduced by “y” percent?
 - what is the impact of local controls?
 - what is the impact of regional/national controls resulting in reduction of regional background?



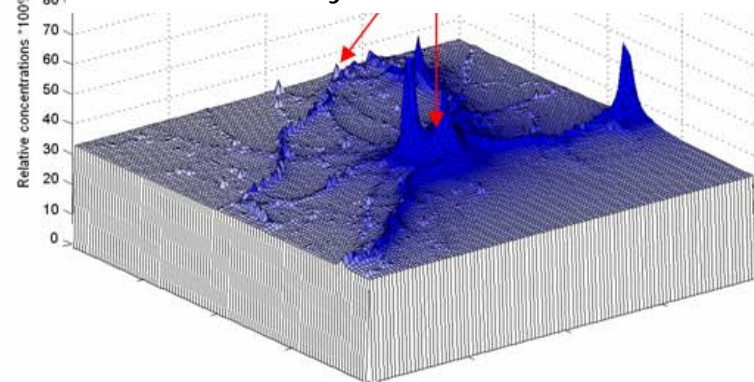
Hypothetical Example: Modeling impact of various controls for stationary sources, mobile sources, and regional background



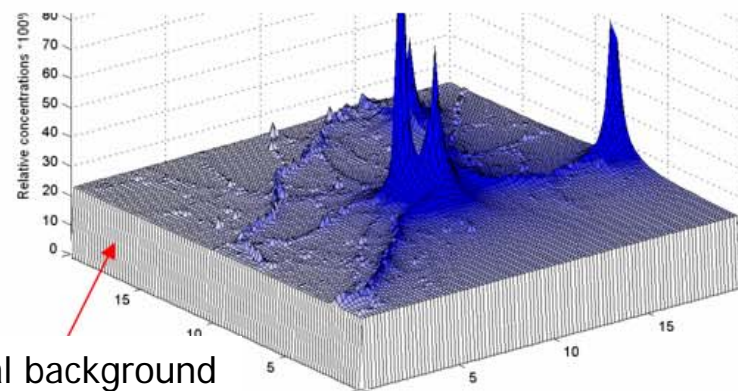
Reducing emissions from mobile sources



Reducing emissions from mobile and some stationary sources



Reducing regional background

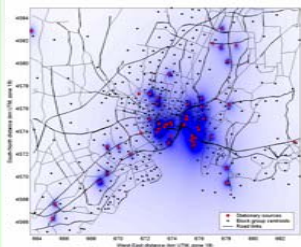


Linking Air Quality Models to Exposure Models

AQ Model Results

- Modeled ambient conc. at census tract centroids
- using
 - Emissions
 - Meteorology

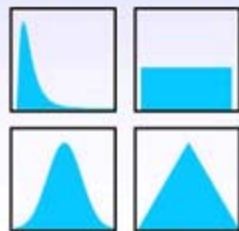
Ambient Concentrations



Input Databases

- Census
- Human Activity
- Food Residues
- Recipe/Food Diary

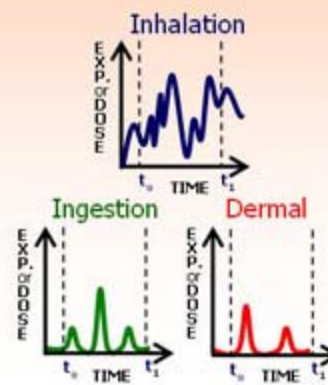
Exposure Factor Distributions



Algorithms

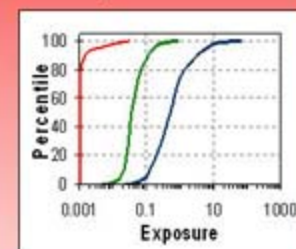


- Calculate Individual Exposure/Dose Profile

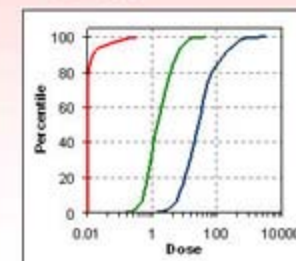


Exposure Model Output

- Population Exposure



- Population Dose



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Exposure Modeling

- Evaluate alternative techniques for estimating cumulative exposures to selected air toxics, PM, and ozone
- Probabilistic cumulative exposure models: HAPEM6 and SHEDS-Air Toxics
 - time-series based models using human activity pattern data, modeled/measured concentrations, exposure factors



Modeling Exposures Using HAPEM and SHEDS

- Modify HAPEM6:
 - to enhance its time-averaging capabilities ranging from hours to days to months
 - to enable it to calculate exposures to multiple pollutants by the same individual (e.g., time-activity patterns, ME factors, commuting patterns, etc.)
 - to have it provide exposure estimates at either, census block, census block group or census tract
- Obtain representative ME factors from the recent HAPEM application for the NATA study
- Using the ME factors, run the modified HAPEM6 and SHEDS-Air Toxics to predict cumulative exposures to selected air toxics in New Haven



Preliminary Results

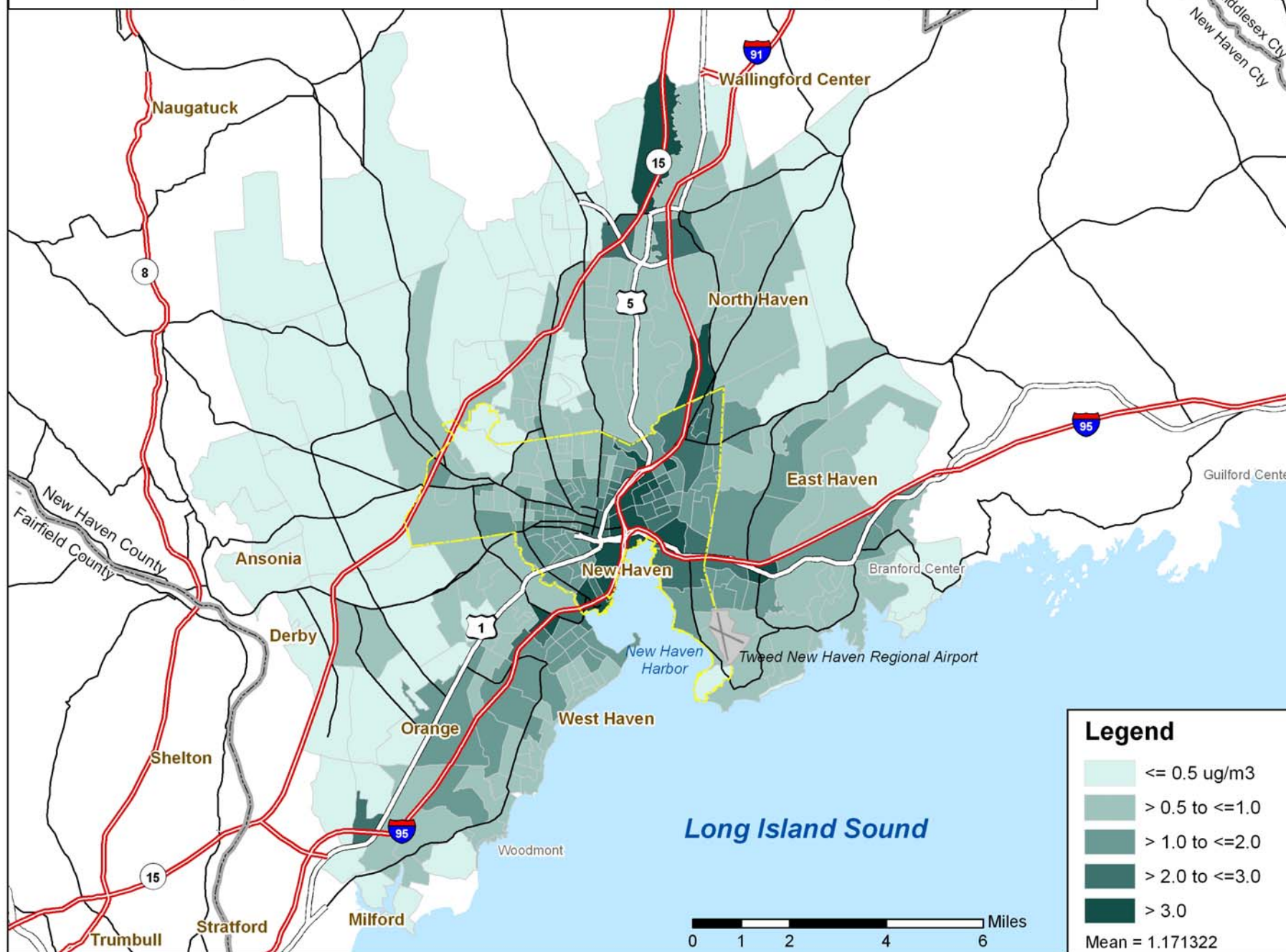
Exposures from HAPEM



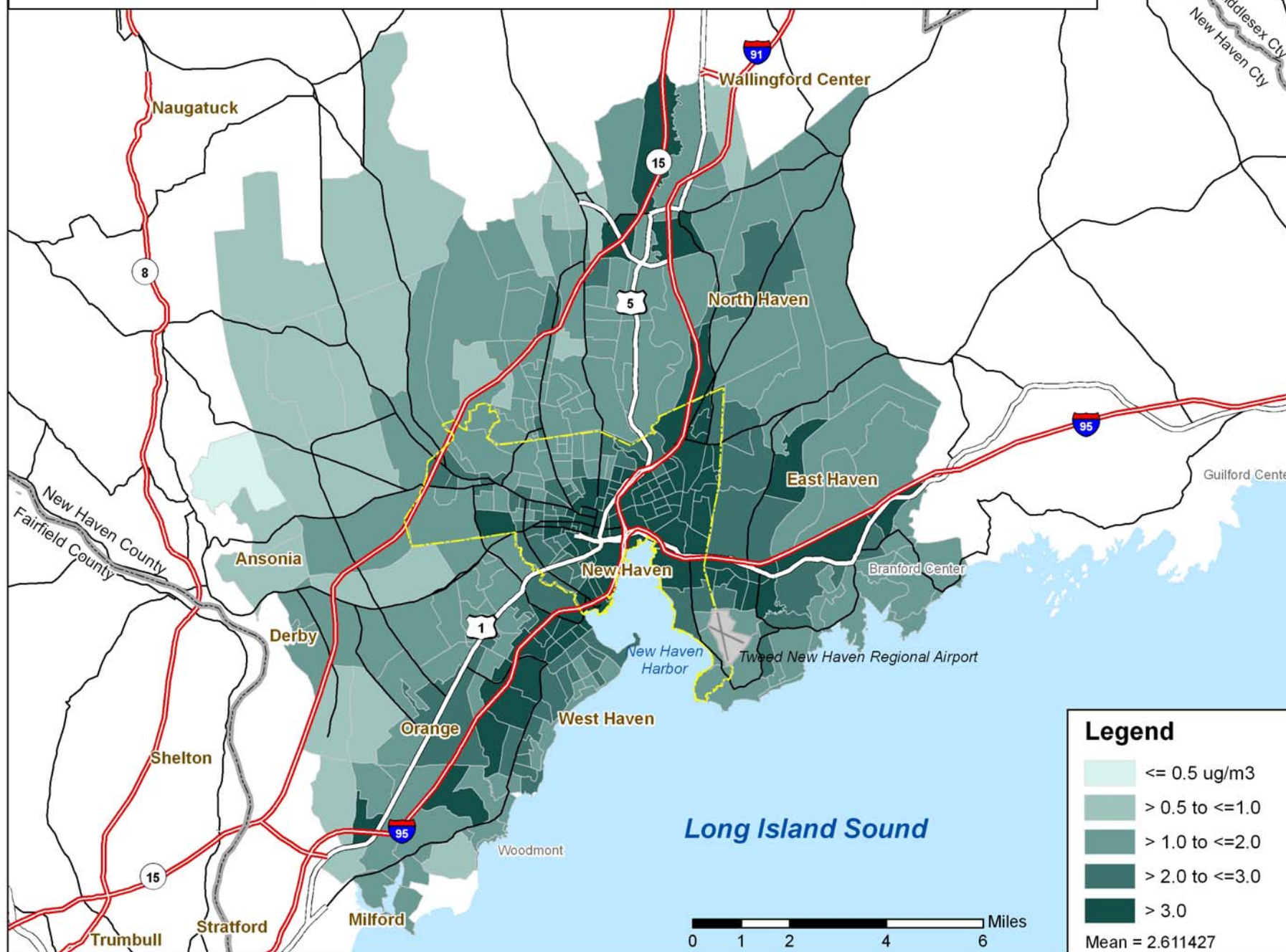
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Median Annual Exposure Concentrations of Benzene in New Haven, CT (HAPEM model)



95th Percentile Annual Exposure Concentrations of Benzene in New Haven, CT (HAPEM model)



Preliminary Results

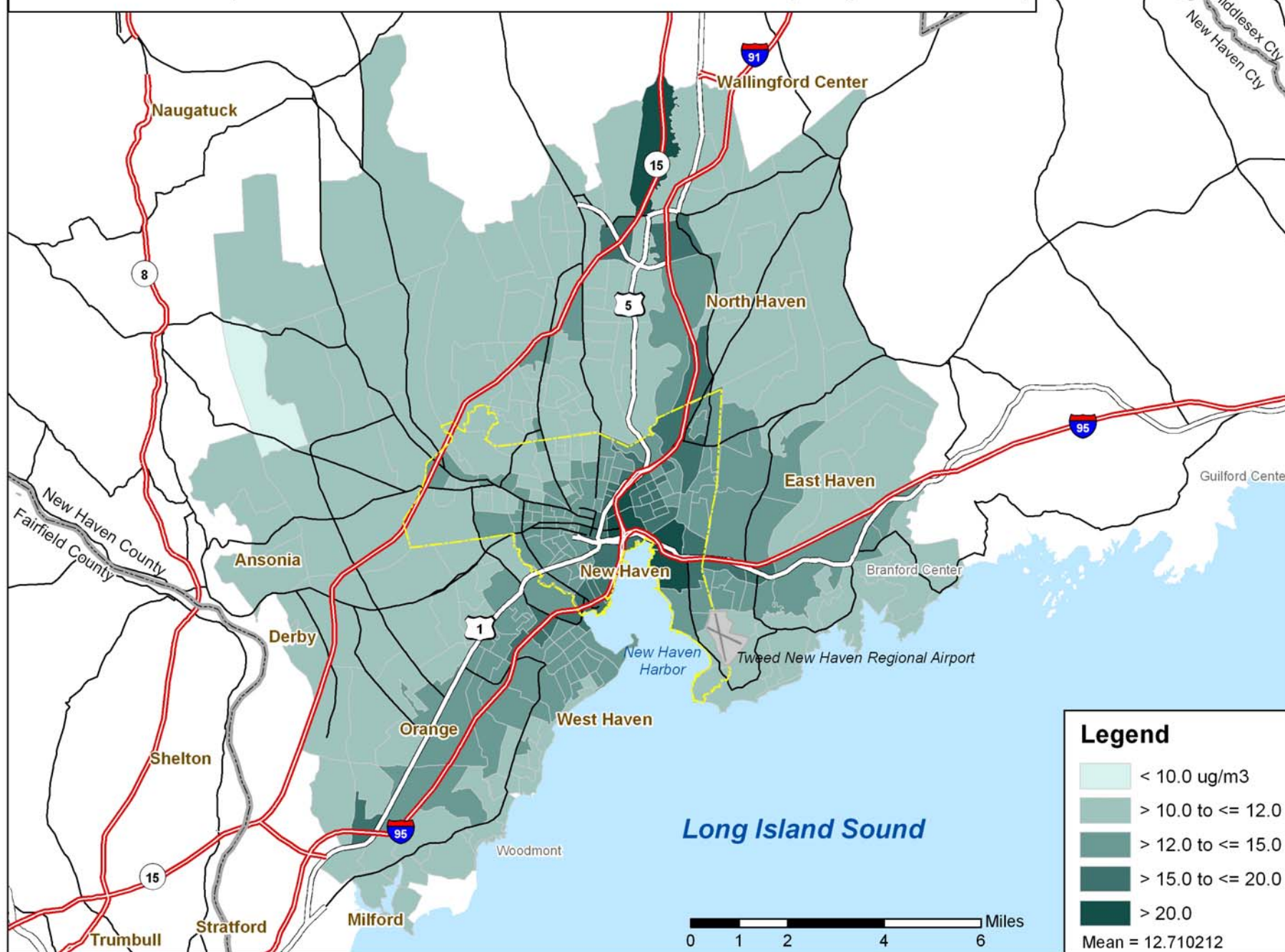
Exposures from SHEDS



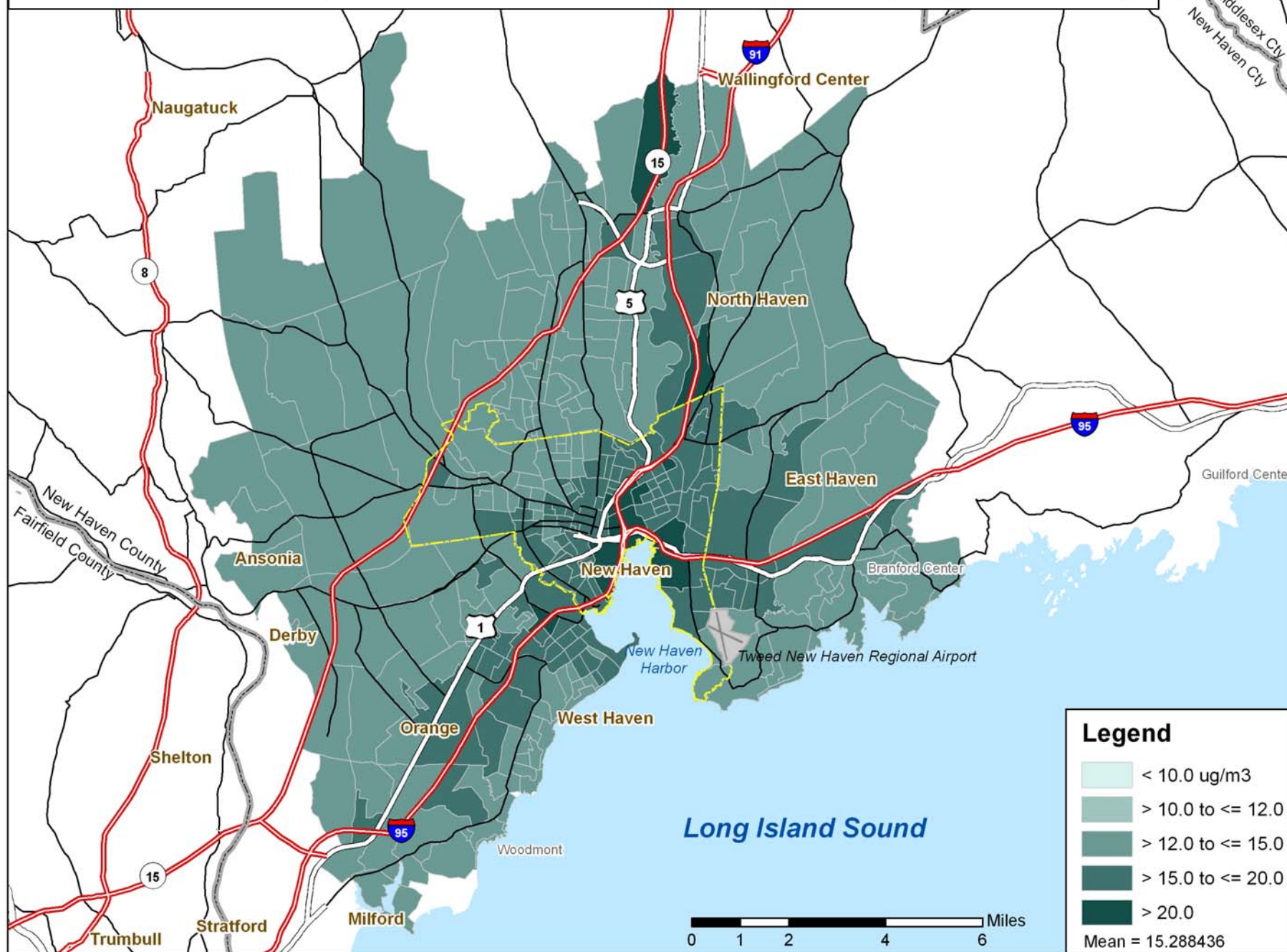
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Median Annual Exposure Concentrations of PM2.5 in New Haven, CT (SHEDS model)



95th Percentile Annual Exposure Concentrations of PM2.5 in New Haven, CT (SHEDS model)



Establish Collaborations



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Meeting with Data Owners and Researchers in New Haven

- Discussed our project and began dialogue (January 2007)
- In attendance
 - Health data owners
 - Air quality data owners
 - Researchers from State Agencies, Local Agencies, Academia, and community organizations
- Continuing dialogue



Activities in Progress

- Updating White Paper
- Determining the air pollution reduction activities and associated changes in emissions for multiple pollutants
- Linking air quality models to exposure models for multiple pollutants over the different study periods



Feasibility and Next Steps

- Assessing if the health data can be linked with the exposure data
- Assessing the feasibility of whether or not the use of existing databases along with air quality and exposure model predictions will be sufficient for demonstrating the impacts due to different voluntary and regulatory actions
- Determining what additional data or analyses will be needed if it is not feasible to adequately link exposure-related information with available health data
- Examine the possibility of utilizing techniques developed for New Haven and lessons learned in other local areas or communities



Collaborators

Emissions Inventories

- MaryBeth Smuts (EPA/Region 1)
- Joe Touma (EPA/NOAA)
- Dennis Pagano (EPA/OAQPS)
- Ct. Dept. of Transportation/Environment

Air Quality Modeling

- Vlad Isakov (EPA/NOAA)
- Joe Touma (EPA/NOAA)
- Rich Cook (EPA/OTAQ)
- Chad Bailey (EPA/OTAQ)
- Ct. Dept. of Transportation/Environment

Exposure Modeling

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- Valerie Zartarian (EPA/ORD)
- Jianping Xue (EPA/ORD)
- Halûk Özkaynak (EPA/ORD)
- Ted Palma (EPA/OAQPS)

Linkage to Health Data

- Danelle Lobdell (EPA/ORD)
- Halûk Özkaynak (EPA/ORD)
- Marybeth Smuts (EPA/Region 1)

Contractor Support:

- Westat
- Alion
- CSC

